Appendix A
Design References

A.1 INTRODUCTION

General references used by the Department for the design, construction, rating, and evaluation of bridges and structures are listed below. References necessary for specific design procedures are presented in each chapter, as appropriate. Use the most current edition of each publication. These references should not be construed as design specifications. This list, although comprehensive, should not be construed as all-inclusive.

A.2 DESIGN REFERENCES

American Association of State Highway and Transportation Officials (AASHTO)
http://www.transportation.org/aashto/home.nsf/FrontPage

- *AASHTO/AGC/ARTBA Guide Specifications for Concrete Overlays of Pavements and Bridge Decks*
- *AASHTO Guide Specifications for Highway Bridge Fabrication with HPS70W Steel*
- *AASHTO Guide Specifications–Thermal Effects in Concrete Bridge Superstructures*
- *AASHTO LRFD Bridge Construction Specifications*
- *AASHTO LRFD Bridge Design Specifications (AASHTO Specifications)*
- *A Guide for Protective Screening of Overpass Structures*
- *ANSI/AASHTO/AWS Bridge Welding Code D1.5 and Commentary*
- *A Policy on Geometric Design of Highways and Streets (Green Book)*
- *Construction Handbook for Bridge Temporary Works*
- *Corrosion Protection of Steel Hardware Used in Modern Timber Bridges*
- *Design, Construction and Quality Control Guidelines for Stress Laminated Timber Bridge Decks*
- *Foundation Investigation Manual*
- *Guide Design Specifications for Bridge Temporary Works*
- *Guide Specifications and Commentary for Vessel Collision Design of Highway Bridges*
- *Guide Specifications for Alternate Load Factor Design Procedure for Steel Beam Bridges Using Braced Compact Sections*
- *Guide Specifications for Aluminum Highway Bridges*
- *Guide Specifications for Bridge Railings*
- *Guide Specifications for Design and Construction of Segmental Concrete Bridges*
- *Guide Specifications for Distribution of Loads for Highway Bridges*
- *Guide Specifications for Fatigue Design of Steel Bridges*
- *Guide Specifications for Fatigue Evaluation of Existing Steel Bridges*
- *Guide Specifications for Fracture Critical Non-Redundant Steel Bridge Members*

- *Guide Specifications for Horizontally Curved Highway Bridges*
- *Guide Specifications for Seismic Isolation Design*
- *Guide Specifications for Strength Design of Truss Bridges (Load Factor Design)*
- *Guide Specifications for Strength Evaluation of Existing Steel and Concrete Bridges*
- *Guide Specifications for Structural Design of Sound Barriers*
- *Guide Specifications for the Design of Stress-Laminated Wood Decks*
- *Highway Drainage Guidelines, Volumes I through VIII*
- *Manual for Condition Evaluation of Bridges*
- *Manual for Corrosion Protection of Concrete Components in Bridges*
- *Manual for Maintenance Inspection of Bridges*
- *Manual on Subsurface Investigations*
- *Movable Bridge Inspection, Evaluation and Maintenance Manual*
- *Roadside Design Guide*
- *Standard Specifications for Highway Bridges*
- *Standard Specifications for Movable Highway Bridges*
- *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*
- *Standard Specifications for Transportation Materials and Methods of Sampling and Testing–Part I, Specifications*
- *Standard Specifications for Transportation Materials and Methods of Sampling and Testing–Part II, Methods of Sampling and Testing*

American Concrete Institute (ACI)
http://www.aci-int.org/general/home.asp

- *Recommendations for Design, Manufacture and Installation of Concrete Piles, ACI-543*

American Forest and Paper Association - American Wood Council
http://www.awc.org/index.html

- *National Design Specification (NDS) for Wood Construction, ANSI/AF&PA NDS*

American Institute of Steel Construction (AISC)
http://www.aisc.org/

- *Manual of Steel Construction*
- *Moment, Shears, and Reactions for Continuous Highway Bridges*
- *Sheet Piling Design Manual*
- *Wrought Iron and Steel Beams and Columns, 1873-1952*, Herbert W. Ferris

American Institute of Timber Construction
http://www.aitc-glulam.org/

- *Timber Construction Manual*

American Railway Engineering and Maintenance-of-Way Association (AREMA)
http://www.arema.org

- *Manual for Railway Engineering, Volume I*

American Society for Testing Materials (ASTM)
http://www.astm.org

DelDOT follows the AASHTO *Standard Specifications for Transportation Materials and Methods of Sampling and Testing–Parts I* and *II* insofar as possible. Where appropriate specifications or tests are not covered in these two AASHTO publications, the *Annual Book of ASTM Standards* is used. Each section of the standards contains specifications and testing requirements for material in that section. The construction section includes testing of concrete, aggregates, road and paving materials, as well as other building

materials. Other sections that may be helpful include:

- iron and steel products;
- nonferrous metal products;
- metals test methods and analytical procedures; and
- paints and related coatings.

Delaware Department of Transportation (DelDOT)

Some of these publications are available from DelDOT's web site at:
http://www.deldot.net/static/publications_forms.html

- *Bridge Maintenance Manual*
- *Bridge Management Manual*
- *CADD Standards*
- *Construction Manual*
- *Delaware's Historic Bridges: Survey and Evaluation of Historic Bridges with Historic Contexts for Highways and Railroads*
- *Materials Manual*
- *Policy Implements*
- *Professional Services Procurement Manual*
- *Project Development Manual*
- *Right-of-Way Manual*
- *Road Design Manual*
- *Standard Construction Details*
- *Standard Specifications for Road and Bridge Construction* (*Standard Specifications*)
- *Supplemental Specifications*
- *Traffic Calming Design Manual*
- *Traffic Controls for Street and Highway Construction and Maintenance Operations*
- *Traffic Summary*
- *Utilities Design Manual*

Department of Natural Resources and Environmental Control (DNREC)
http://www.dnrec.state.de.us

- *Delaware Erosion and Sediment Control Handbook*
- *Sedimentation Control Manual*

Federal Emergency Management Administration (FEMA)
http://www.fema.gov/

- *Procedures for Coordinating Highway Encroachments on Floodplains with Federal Emergency Management Agency*

Federal Highway Administration (FHWA)
http://www.fhwa.dot.gov/

- *Bridge Inspector's Reference Manual, FHWA NHI 03-001*
- *Bridge Maintenance Training Manual, FHWA-HI-94-034*
- *Bridge Waterways Analysis Model: Research Report, Report No. RD-86/108*
- *DRIVEN, A Program for Determining Ultimate Vertical Static Pile Capacity, User's Manual, FHWA-SA-98-074*
- *Economical and Fatigue Resistant Steel Bridge Details, Publication FHWA-HI-90-043*
- *Fatigue Cracking of Steel Bridge Structures, Volume I, RD-89-166*
- *Fatigue Cracking of Steel Bridge Structures, Volume II, RD-89-167*
- *Fatigue Cracking of Steel Bridge Structures, Volume III, RD-89-168*
- *Flexibility in Highway Design*
- *Forum on Weathering Steel for Highway Structures: Summary Report, Publication No. FHWA-TS-89-016*
- *Geotextile Design and Construction Guidelines, FHWA-HI-90-001*
- *Highways in the River Environment, FHWA-HI-90-016*
- Hydraulic Design Series (HDS)
  - *HDS-1, Hydraulics of Bridge Waterways, Hydraulic Design Series 1*
  - *HDS-5, Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5, Report No. IP-85-15*

- Hydraulic Engineering Circulars (HEC)
  - *HEC-2, Water Surface Profiles, Hydraulic Engineering Circular No. 2*
  - *HEC-11, Design of Riprap Revetment, Hydraulic Engineering Circular No. 11*
  - *HEC-14, Hydraulic Design of Energy Dissipaters for Culverts and Channels*
  - *HEC-17, The Design of Encroachments of Flood Plains Using Risk Analysis, Hydraulic Engineering Circular No. 17*
  - *HEC-18, Scour at Bridges, Hydraulic Engineering Circular No. 18, FHWA-IP-90-017*
  - *HEC-19, Hydrology, Hydraulic Engineering Circular No. 19*
  - *HEC-20, Stream Stability at Highway Structures, Hydraulic Engineering Circular No. 20*
  - *HEC-21, Bridge Deck Drainage Systems, Hydraulic Engineering Circular No. 21*
  - *HEC-23, Bridge Scour and Stream Instability Countermeasures, Hydraulic Engineering Circular No. 23*
- Hydraulic Reports
  - HY-8, Culvert Analysis (Version 2.0), computer software
- *Manual on Design and Construction of Driven Pile Foundations, FHWA DP-66-1*
- *Manual on Uniform Traffic Control Devices* (MUTCD)
- *Mechanically Stabilized Earth Walls and Reinforced Soil Slopes: Design and Construction Guidelines, FHWA-SA-96-071*
- *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nations Bridge s, Report No. FHWA-ED-89-044, OMB No. 2125-0501*
- *Scourability of Rock Formations*, FHWA Region 3 Memorandum
- *Standards, FHWA Mid-Atlantic States Structural Committee for Economical Fabrication*

New Castle County

- *Unified Development Code* http://www.co.new-castle.de.us/landuse/webdynamic/landUse11.asp

Post-Tensioning Institute (PTI)
http://www.post-tensioning.org/

- *Post-Tensioning Manual*
- *Recommendations for Stay Cable Design, Testing, and Installation*

Precast/Prestressed Concrete Institute (PCI)
http://www.pci.org/

- *Design Supplement to: Precast Prestressed Concrete, Short Span Bridges, Spans to 100 Feet*

Transportation Research Board (TRB)
http://www4.trb.org/trb/onlinepubs.nsf

TRB publishes numerous research reports each year. In addition to the National Cooperative Highway Research Program (NCHRP) reports, these publications include peer-reviewed research papers presented at the annual meeting. The *TRB Publications Catalog* is issued each year, with listings by category. Reports of most interest to designers are in the Design category, which includes the following:

- Highway and Facility Design;
- Pavement Design, Management, and Performance; and
- Bridges, Other Structures, and Hydraulics and Hydrology.

The NCHRP was established to provide a continuing program of highway research. It

is sponsored by member departments of AASHTO in cooperation with FHWA. NCHRP is administered by the Transportation Research Board of the National Academy of Sciences.

NCHRP has synthesis reports of highway practice which typically determine the state of the art for the state transportation departments, evaluate current procedures, and recommend procedures which best resolve problems. Syntheses in the bridge design area include design of bridge approaches, deck joints, durability of structures, designs to reduce maintenance, prefabricated bridge elements, shallow foundations, underwater inspection, distribution of wheel loads, bridge drainage systems, and pile foundation design.

Some TRB and NCHRP design references are:

- *Design of Pile Foundations, NCHRP Synthesis of Highway Practice 42*
- *Guidelines for Evaluation and Repair of Damaged Steel Bridge Members, NCHRP Report No. 271*
- *Mechanically Stabilized Earth Walls, TR Circular No. 444*

US Army Corps of Engineers
http://www.usace.army.mil/inet/usace-docs/

- *Acquisition of Lands Downstream from Spillways for Hydrologic Safety Purposes, ER 1110-2-1451*
- *Hydraulic Design of Spillways, EM 1110-2-1603*
- *Life Cycle Cost for Drainage Structures, Technical Report GL-88-2*
- *Structural Design and Evaluation of Outlet Works, EM 1110-2-2400*

United States Department of Agriculture
http://www.usda.gov/wps/portal/usdahome

- *Standard Plans for Crash-Tested Bridge Railings for Longitudinal Wood Decks*
- *Timber Bridges—Design, Construction, Inspection and Maintenance*

US Department of Agriculture, Natural Resources Conservation Service (NRCS)
http://www.nrcs.usda.gov/

- TR-20 Computer Program for Project Formulation Hydrology
- *Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55)*
- *National Engineering Handbook*

US Geological Survey (USGS)
http://www.usgs.gov/

- *Technique for Estimating Magnitude and Frequency of Floods in Delaware*

Miscellaneous

- *Bridge Inspection and Rehabilitation, A Practical Guide*, Parsons Brinckerhoff
- COM624P-Laterally Loaded Pile Analysis Program for the Microcomputer, Version 2.0, FHWA-SA-91-048
- *Drilled Shaft Manual, Volume I-Construction Procedures and Design for Axial Loading, and Volume II-Structural Analysis and Design of Lateral Loading*
- *Foundations and Earth Structures, Design Manual DM 7.2*, Naval Facilities Engineering Command, Department of Navy
- *GRLWEAP: Wave Equation Analysis of Pile Driving, Volumes I through VI*, Goble Rausche Likins and Associates, Inc.
- *Pile Foundations*, Chellis, R.D., McGraw-Hill
- *Soils and Foundations Workshop Manual, Cheney, R.S., and Chassis, R.G.*
- *Steel Structures Painting Manual, Volume 1, "Good Painting Practice"*
- *Steel Structures Painting Manual, Volume 2, "Systems and Specifications"*